

# ECE 220

Lecture x0005 - 09/10

Slides based on material originally by: Yuting Chen, Yih-Chun Hu & Thomas Moon

# Recap

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  - Quiz 1 to be 09/16 - 09/18

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  - Midterm 1 on 09/26

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- $(5 + (1 + 2) \times 4) - 3$





# Introduction to C programming

# Why do we need C?



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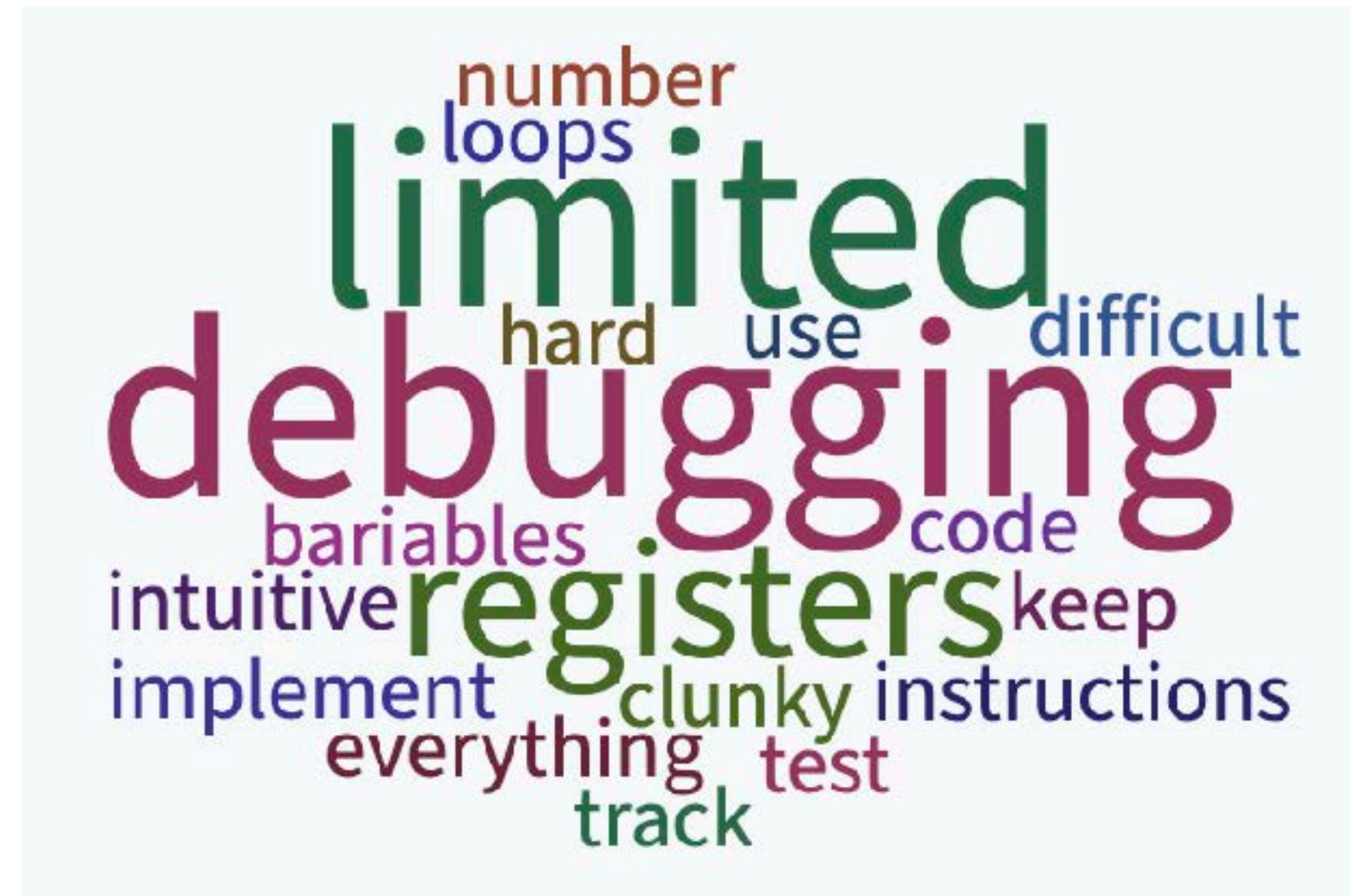
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- Fourth generation: *no consensus*, tend to be highly domain specific.

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- Safeguard against bugs
  - Can enforce rules or conditions at compile-time or run-time

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- **C is an *imperative* procedural language**

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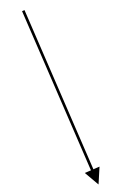
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Compiler knows this shouldn't be permitted; will not compile

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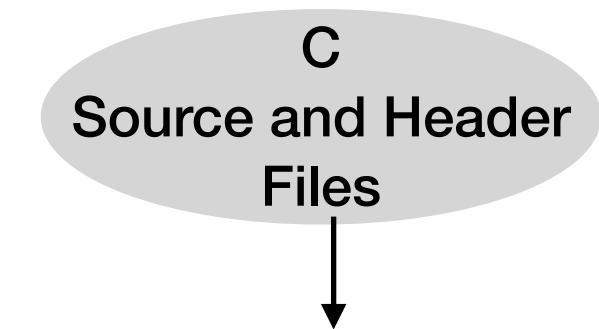
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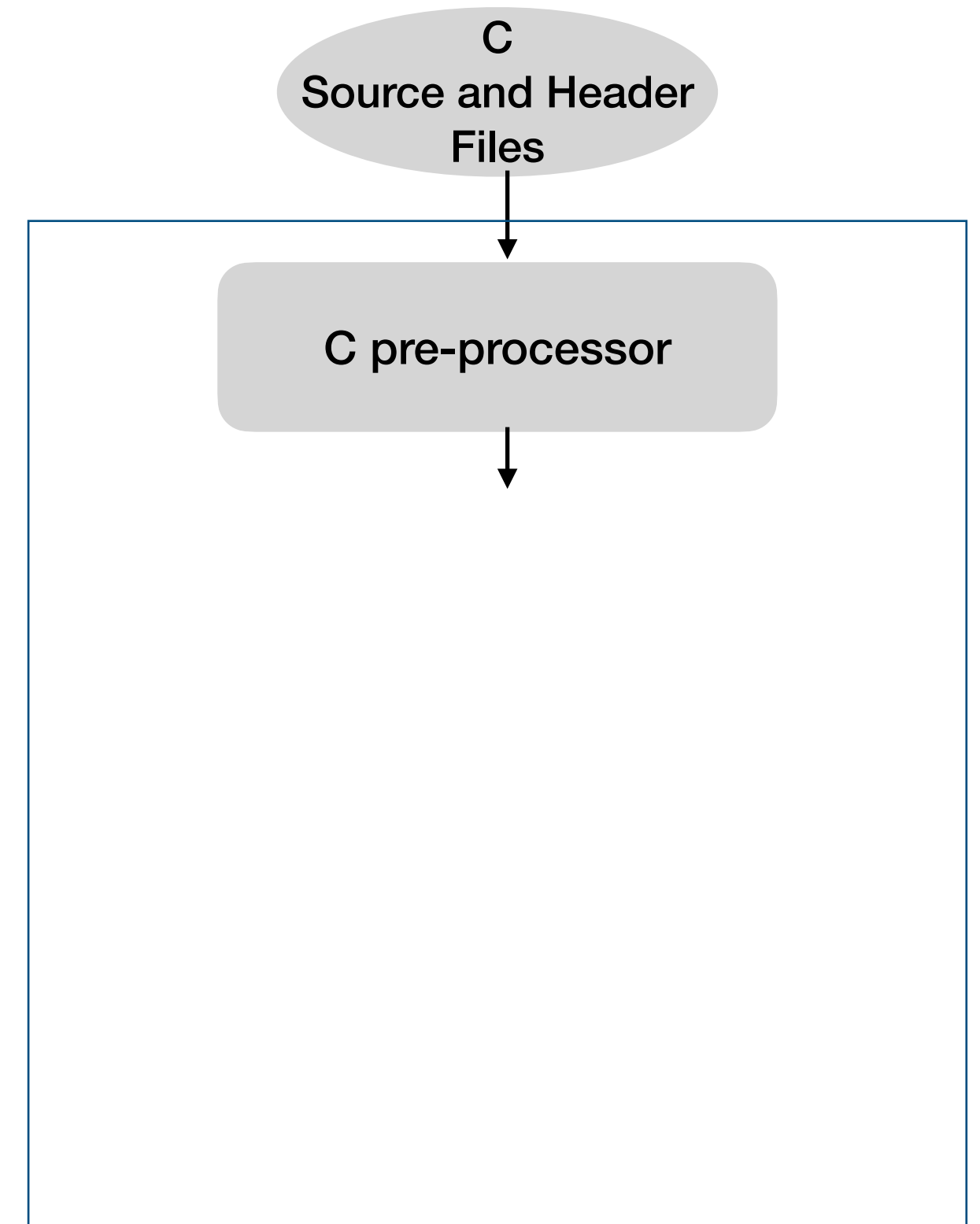
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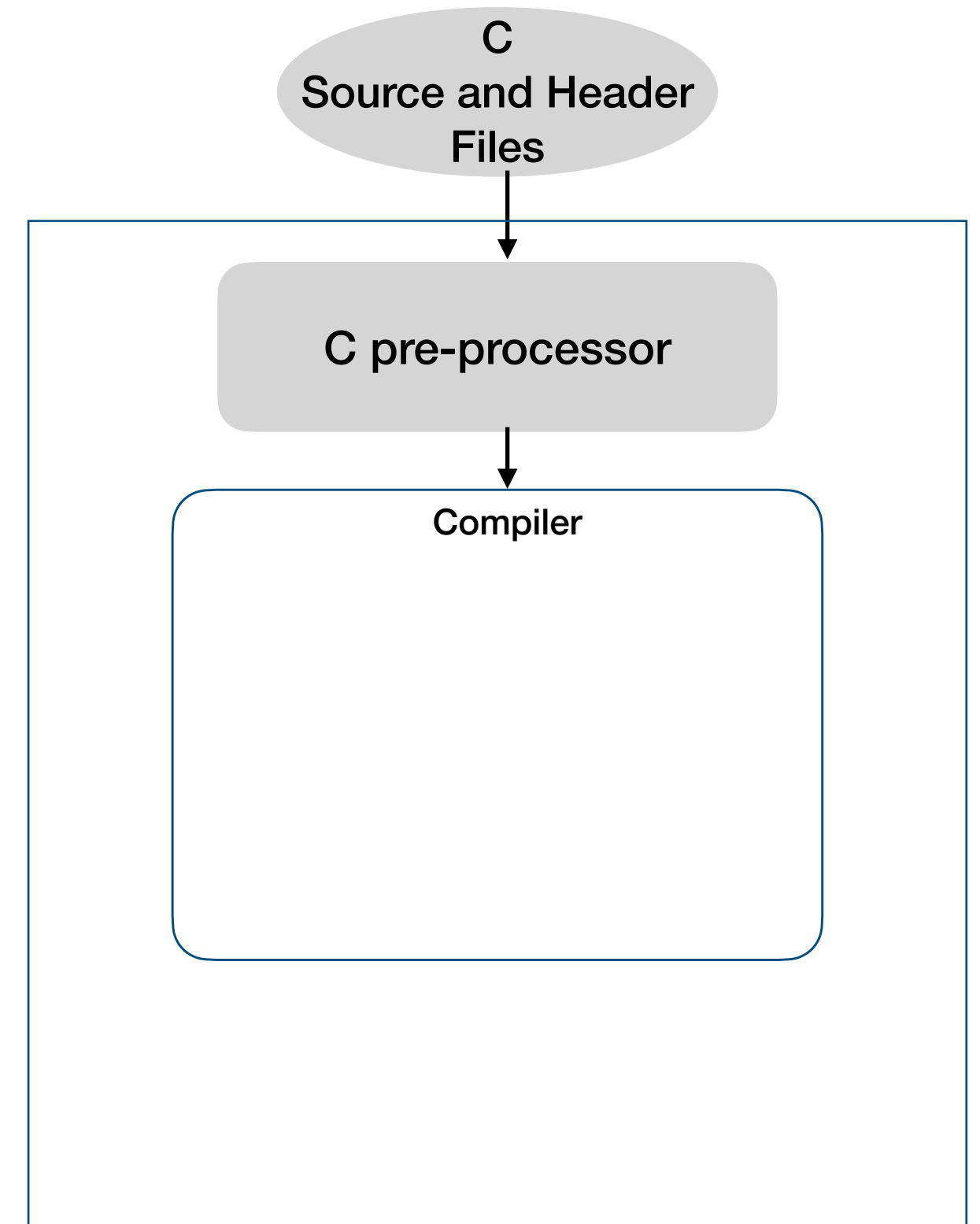
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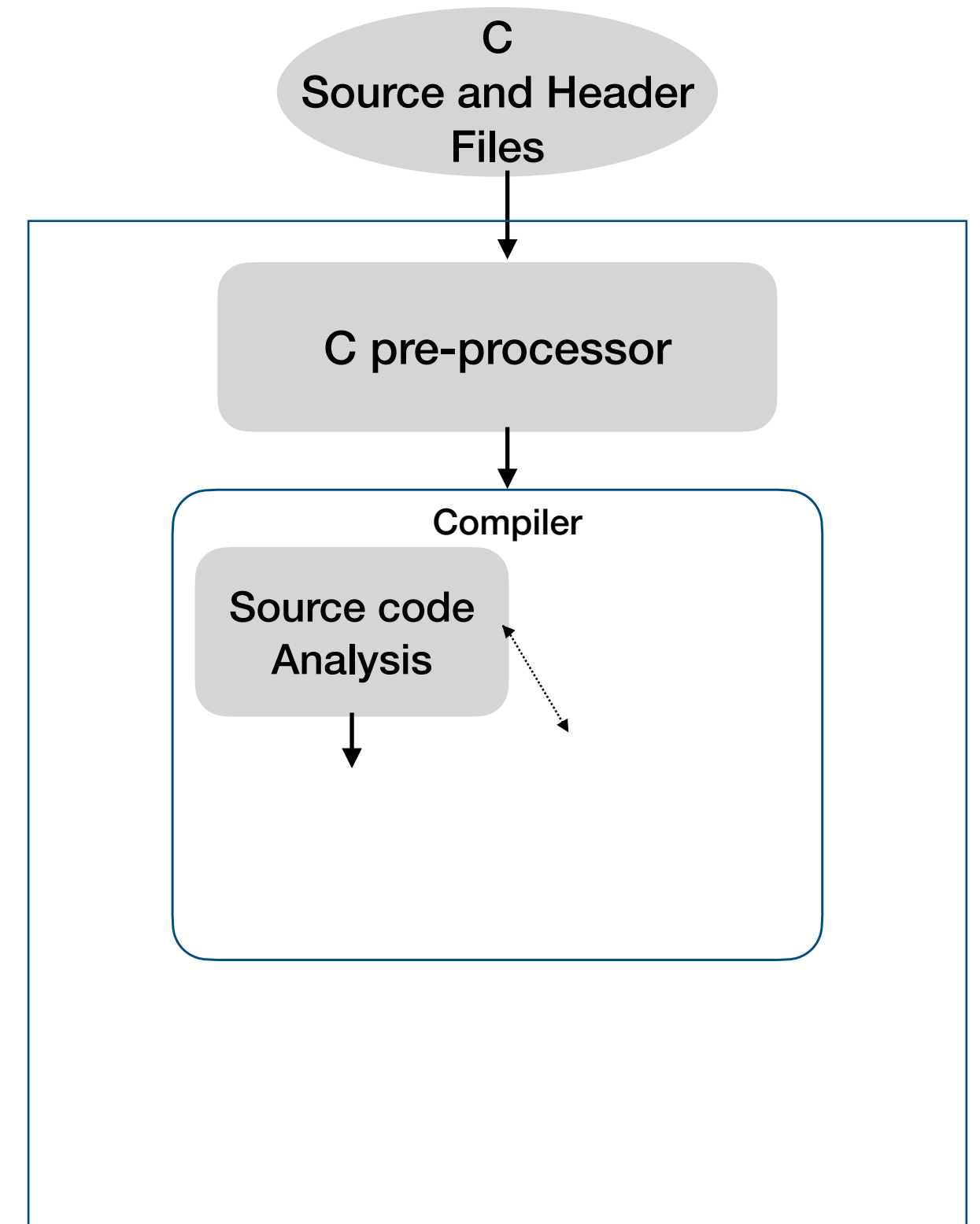
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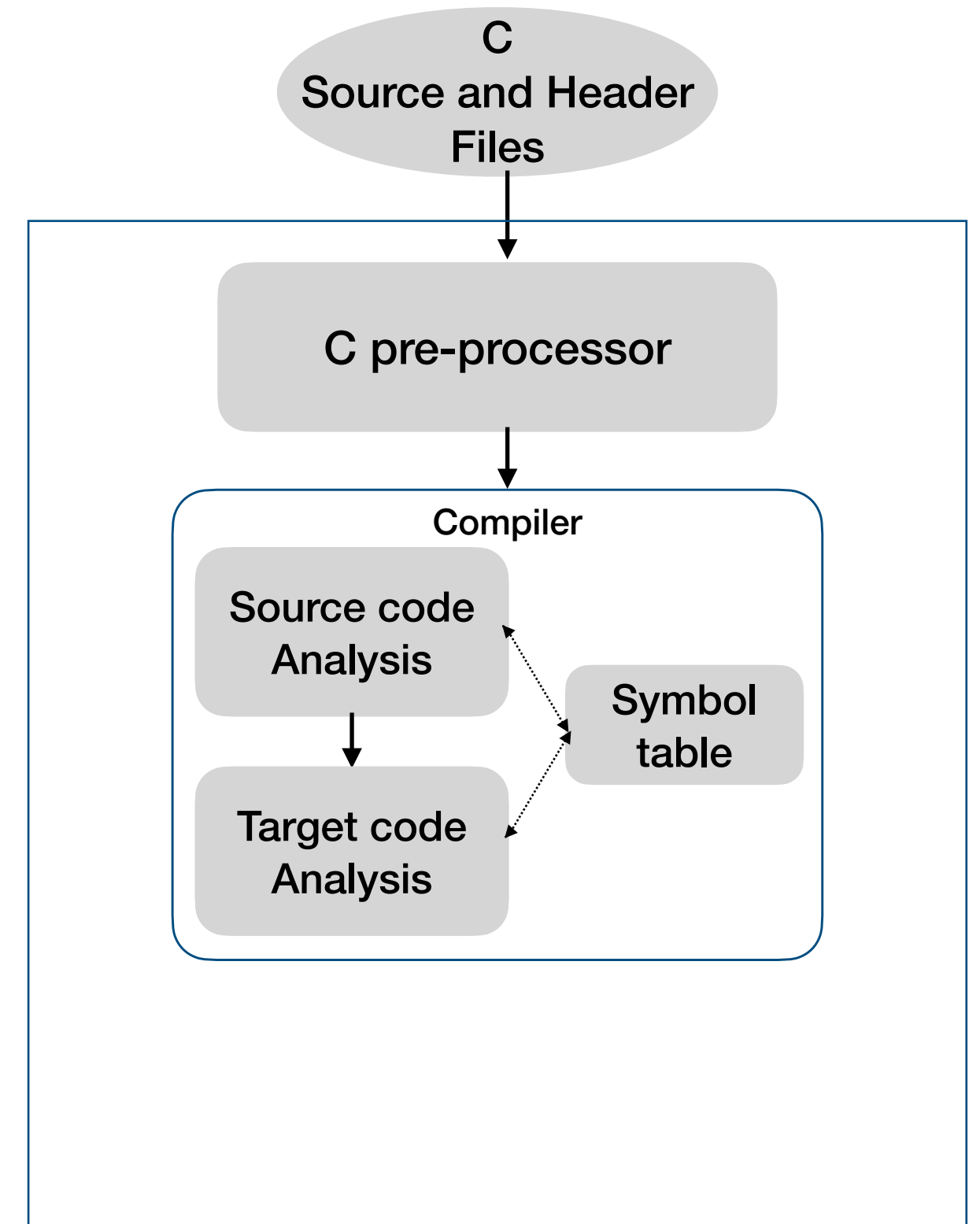
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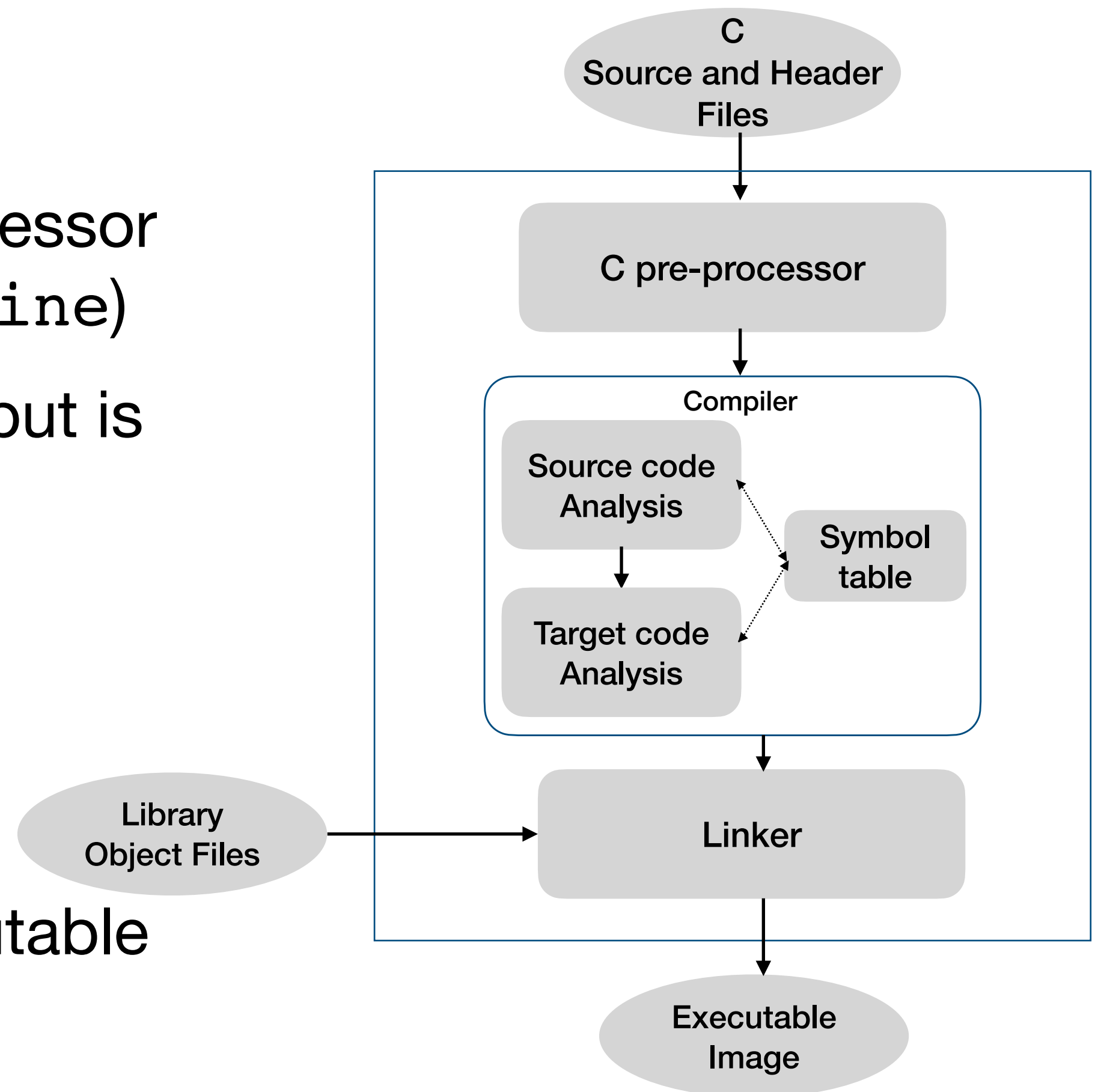
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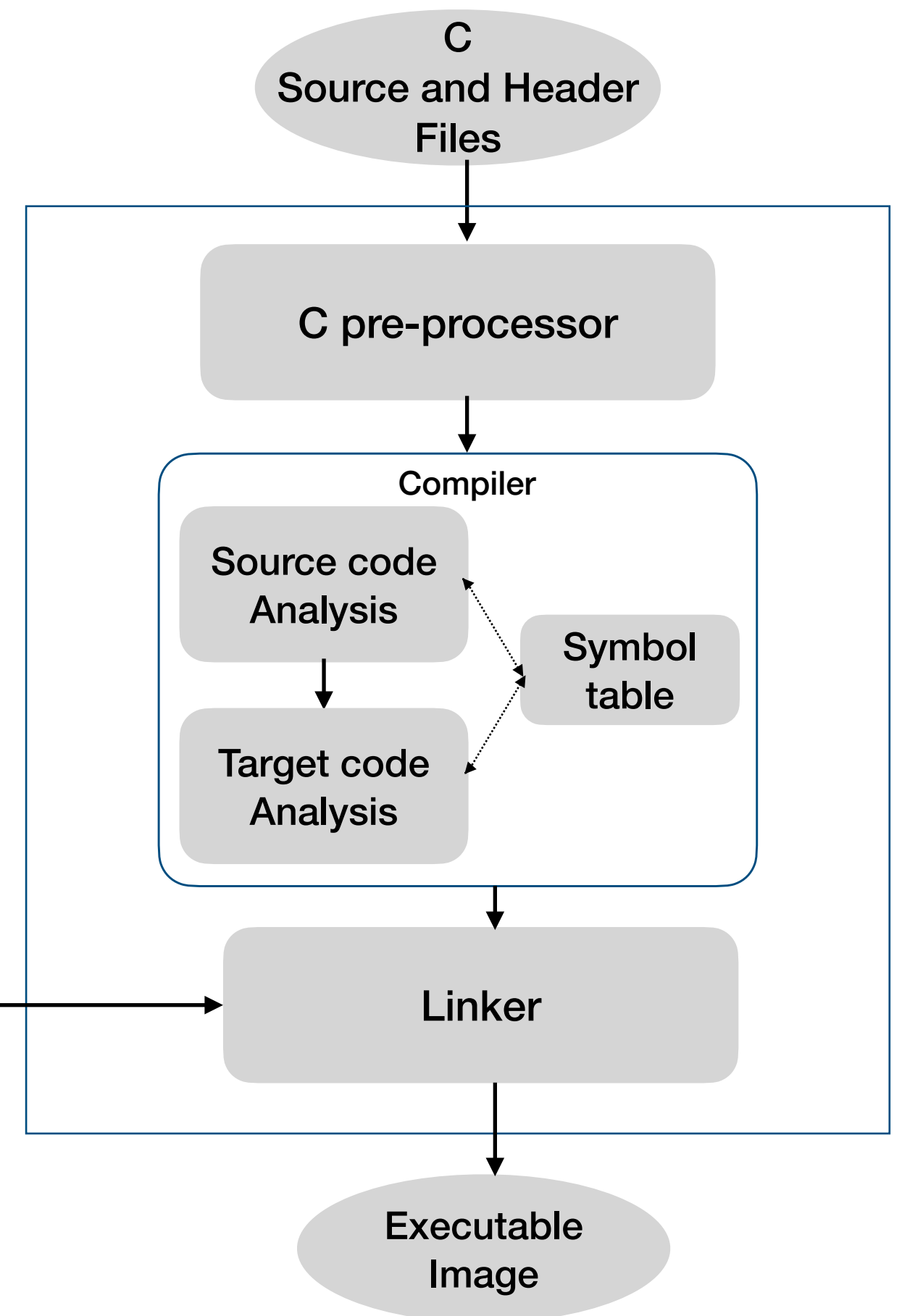
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On EWS we use gcc!



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int main(void){

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    int counter;    // Holds intermediate count values
    int startPoint; // Starting point for count down

    // Prompt the user for input
    printf("==== Countdown Program ====\n");
    printf("Enter a positive integer: ");
    scanf("%d", &startPoint);

    // Count down from the input number to 0
    for (counter = startPoint; counter >= STOP; counter--)
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# From the textbook - Figure 11.3

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int main(int argc, char *argv[])
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- **Exercise:** In C, what is the difference between `int func()` and `int func(void)`?

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More on these I/O commands & program flow topics next lecture.

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Today:

- Using gcc to compile on EWS machines

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Today:

- Using gcc to compile on EWS machines
- Data types, scope/storage and basic operations

# EWS and gcc

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- Typical workflow (recommended but not necessary):

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- Let us run the previous program.

**Demo time: EWS, ssh, gcc,  
manpages, linux commands,  
etc.**

# Basics of C programs

# About variables: data types



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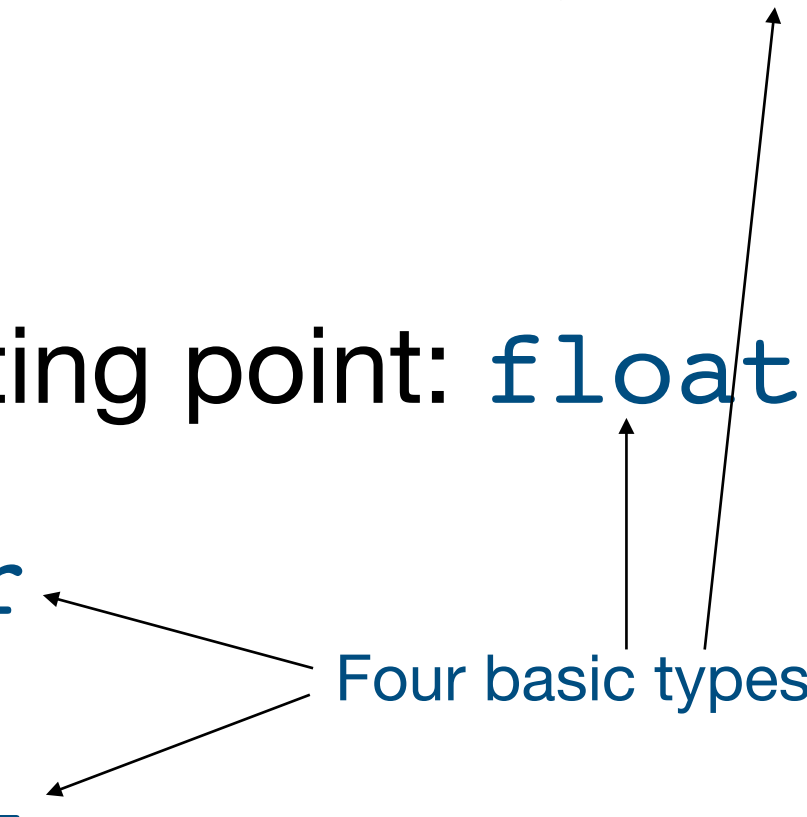
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# About variables: data types

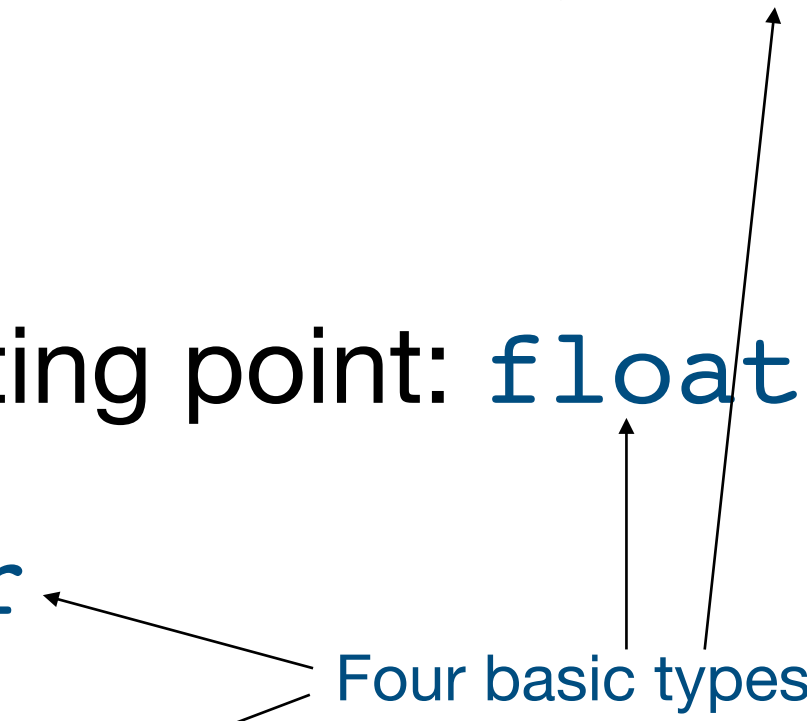
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- Four basic types
- 
- ```
graph LR; A[Four basic types] --> B[char]; A --> C[bool]; A --> D[float]; A --> E[int];
```

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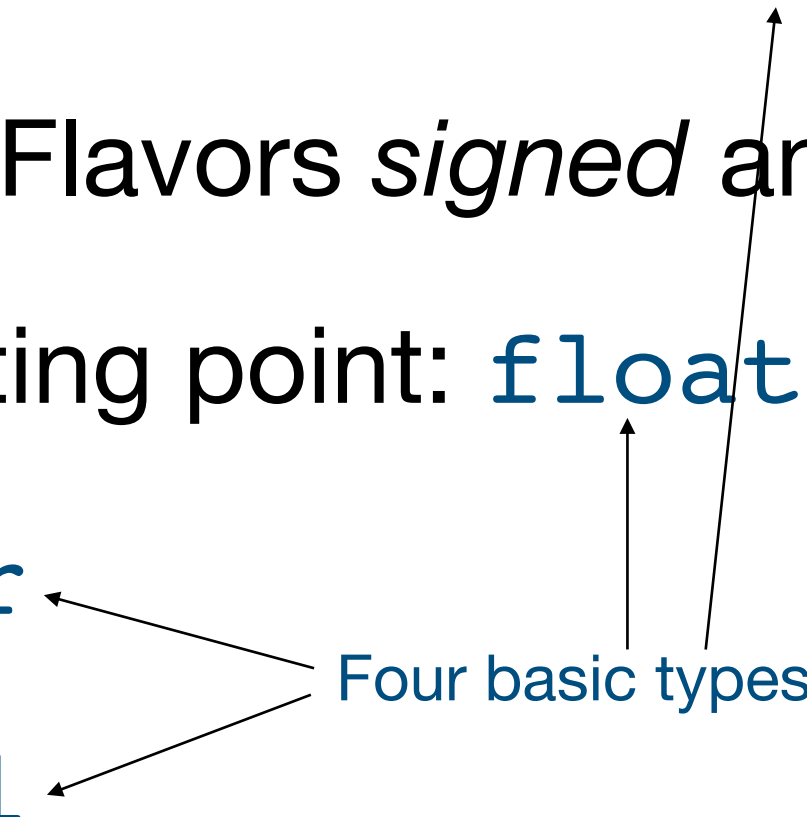
| Bits  | 1    | 8    | 16 | 32    | 64 |
|-------|------|------|----|-------|----|
| Types | Bool | Char |    | Int   |    |
|       |      |      |    | Float |    |

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```

```
#include <stdio.h>
#define PI 3.1416
```

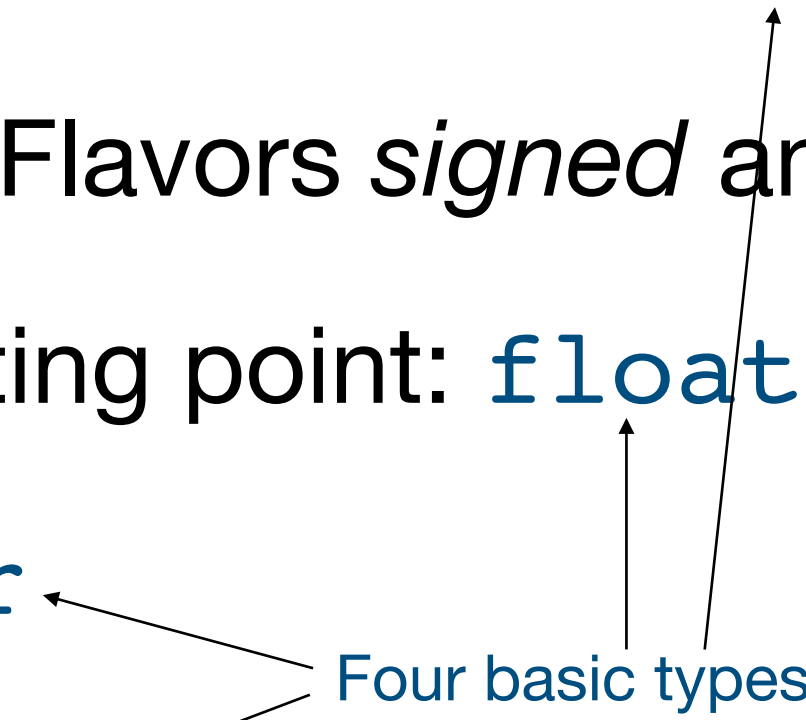
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int main()
{
```

```
    int i = 3;
    float f = 3.14;
    char c = 'M';
```

```
    printf("value of i is %i\n", i);
    printf("value of f is %f\n", f);
    printf("value of c is %c\n", c);
    printf("value of PI is %f\n", PI);
    return 0;
```

```
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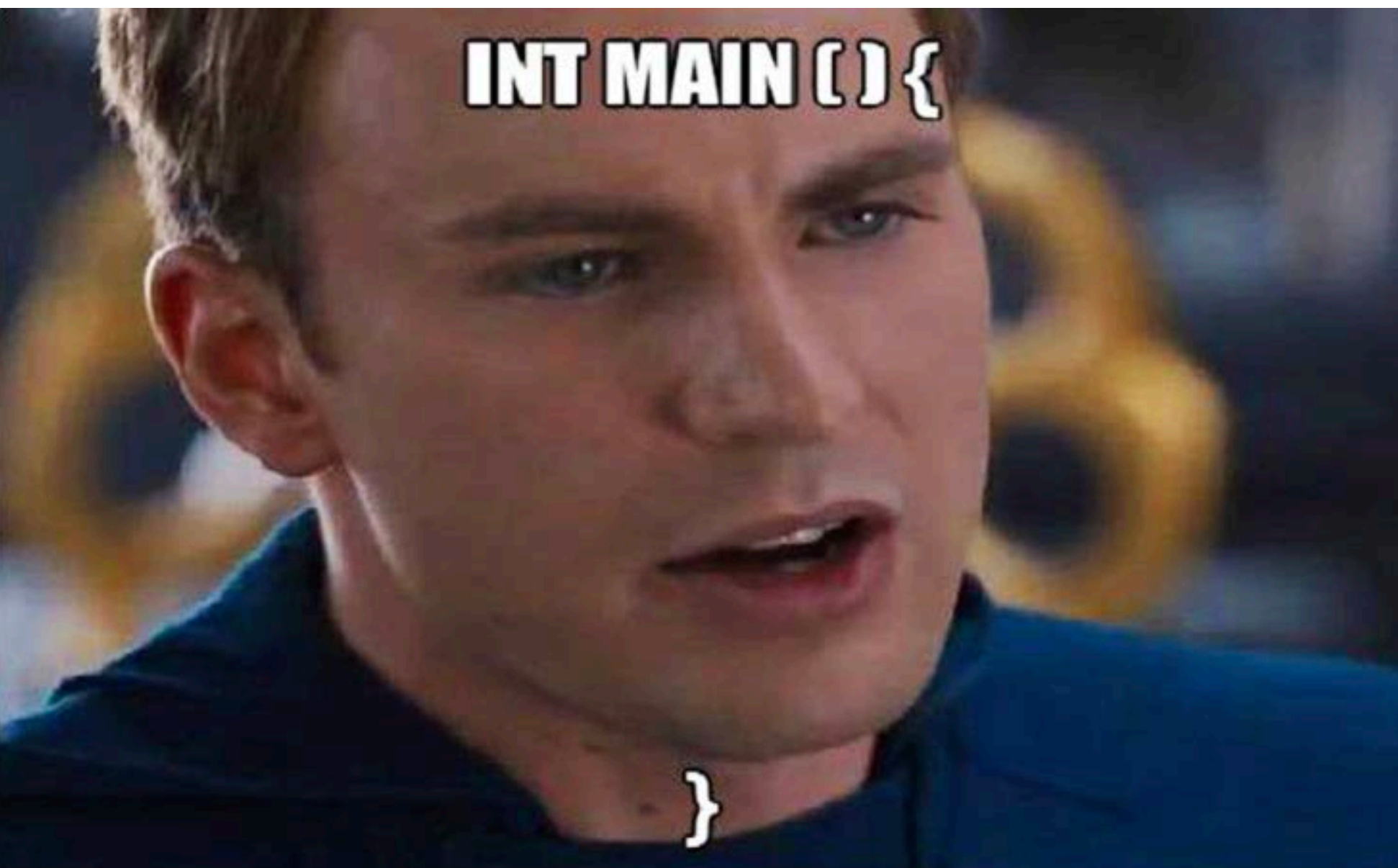
Called *format specifiers*; more about them next lecture.

Single quote for char!

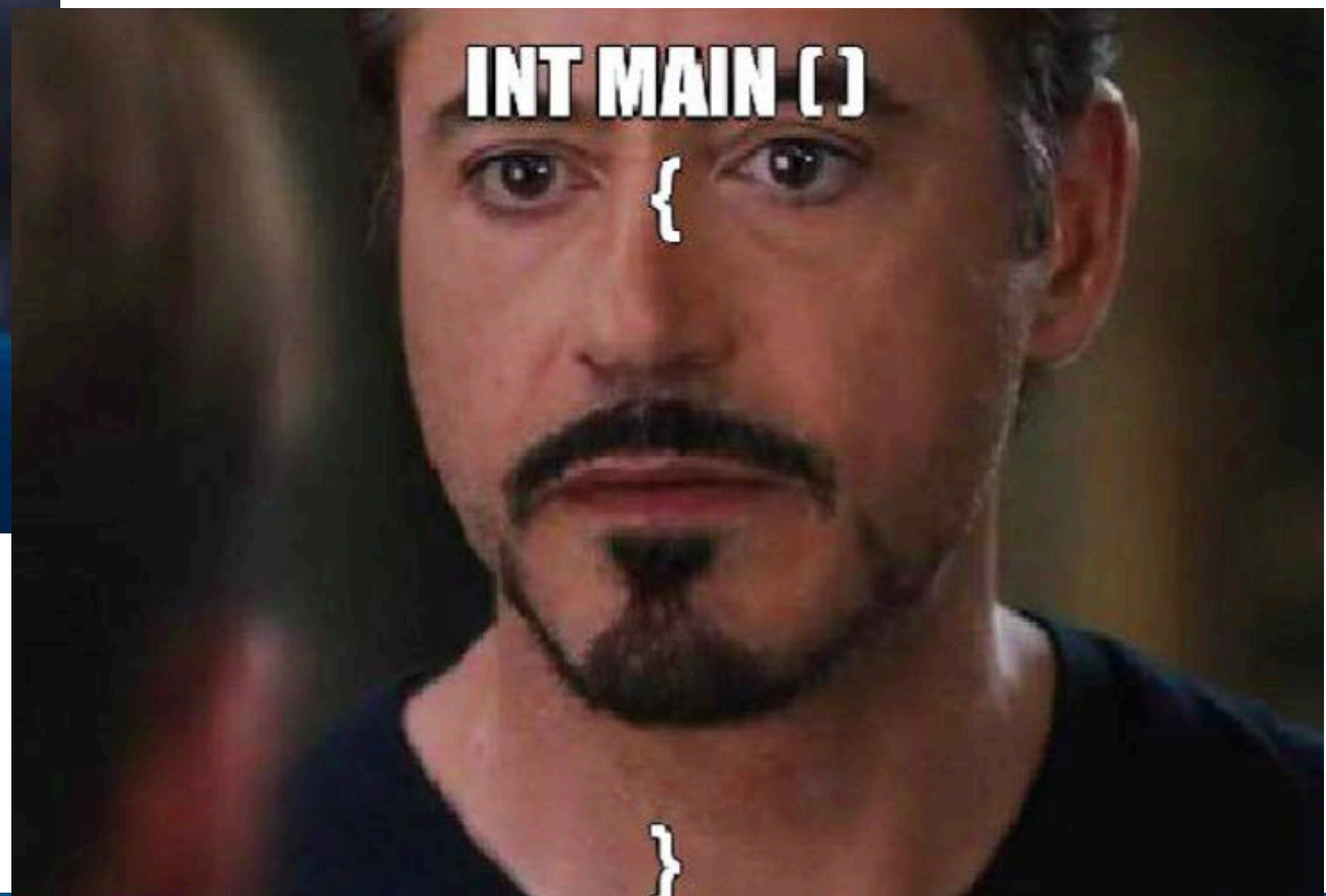
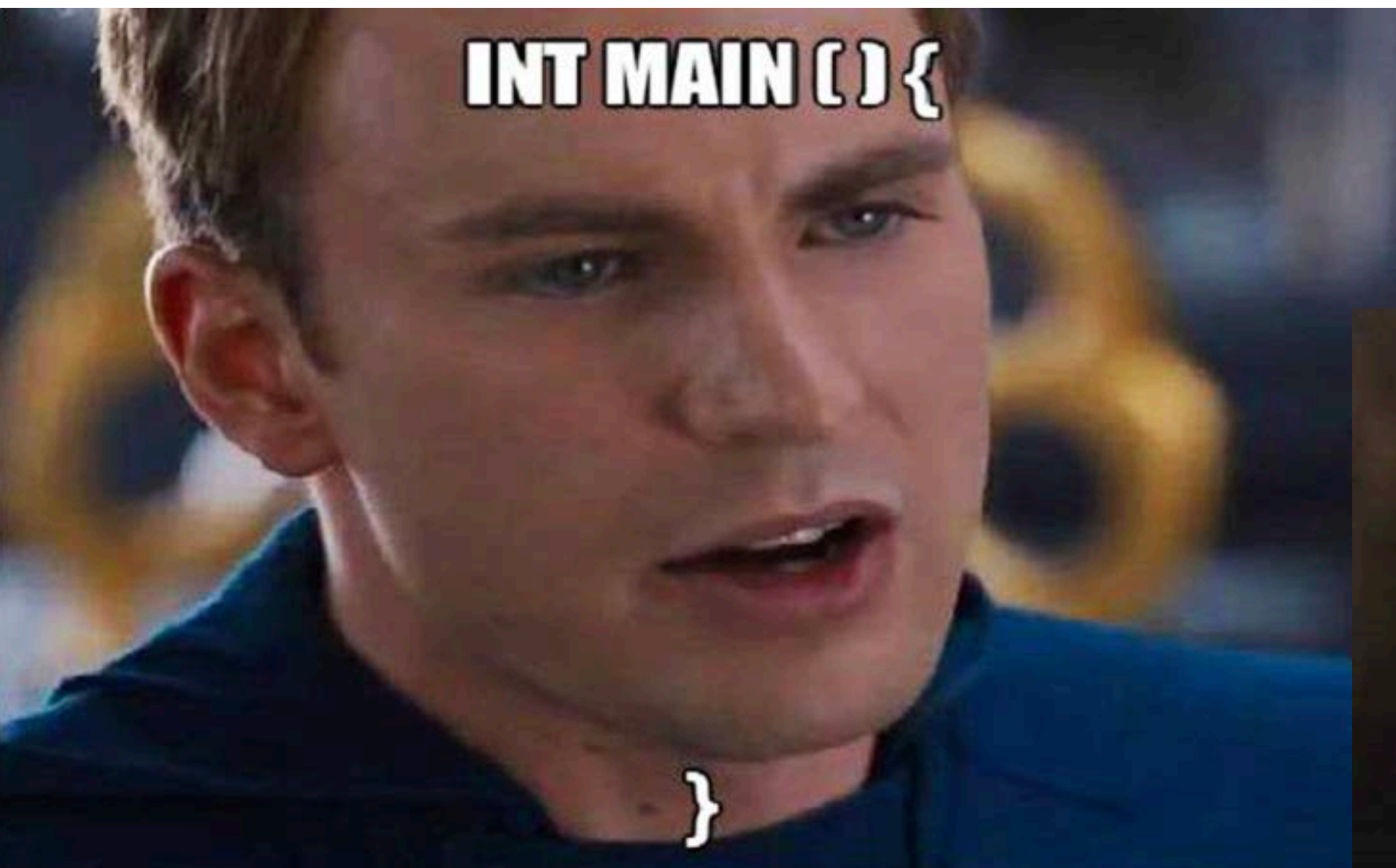
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# Note about styling conventions

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Adopt one and stick to it:  
Course Website





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More links:  
GNU C Convention

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```
int itsGlobal = 0;

int main(){
    /* local to main */
    int itsLocal = 1;
    printf("Global %d Local %d\n", itsGlobal, itsLocal);

    {
        /* local to this block */
        int itsLocal = 2;
        /* change global variable */
        itsGlobal = 4;
        printf("Global %d Local %d\n", itsGlobal, itsLocal);
    }

    printf("Global %d Local %d\n", itsGlobal, itsLocal);
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**Translation unit:** Technical term for a C source file  
*just before* compilation, i.e. already preprocessed.

# About variables: linkage

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**None:** The identifier can be referred to only from the scope it is in. All function parameters and all non-**extern** block-scope variables (including the ones declared **static**) have this linkage

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**Internal:** The identifier can be referred to from all scopes in the current translation unit. All **static** file-scope identifiers (both functions and variables) have this linkage.

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**External:** The identifier can be referred to from any translation units in the entire program. All non-**static** functions, all **extern** variables (unless earlier declared **static**), and all file-scope non-**static** variables have this linkage.

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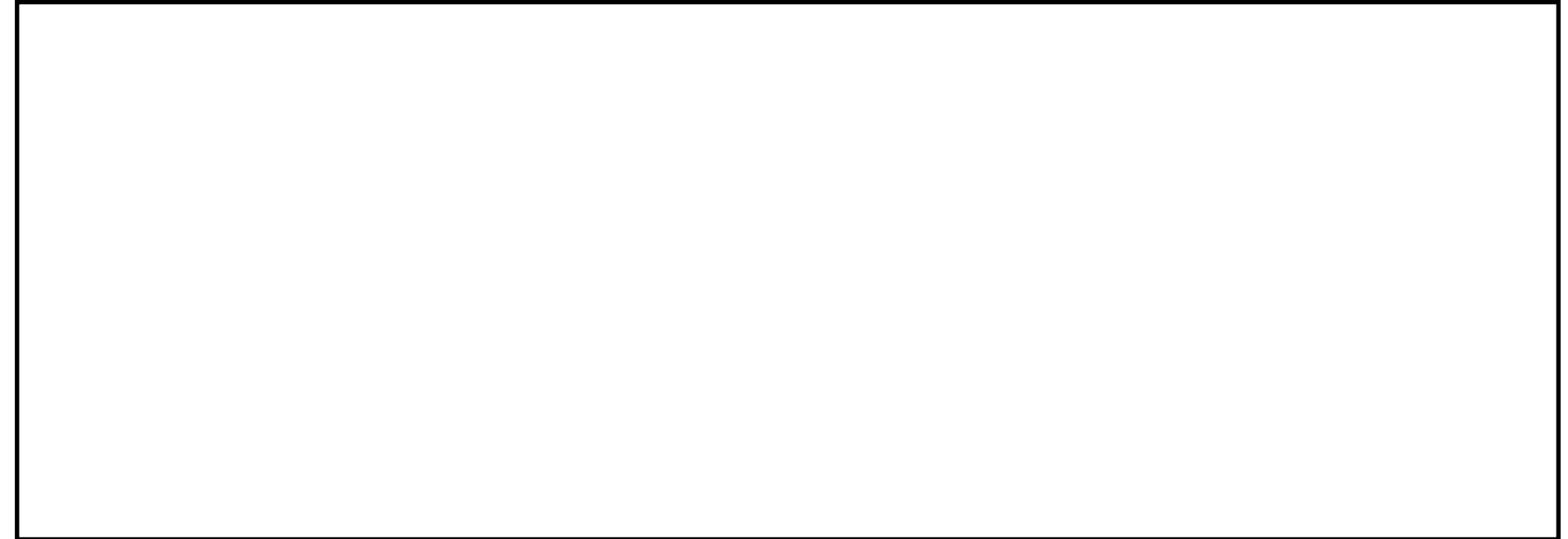
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```
/* This is prog_part.c */
#include <stdio.h>

void foo(int my_num){ // foo has extern linkage
    int a=10;          // a has no linkage
    printf("Foo got %d", my_num);
}
```

```
/* This is prog_main.c */
#include <stdio.h>

void foo(int my_num);

int main(void){
    int a_value = 10;
    printf("Main value is: %d\n", a_value);
    printf("Calling foo with %d \n", ++a_value);
    foo(a_value);
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/* This is prog_part.c */
#include <stdio.h>

int a=10; // A has extern linkage now
static void foo(int my_num){ // Intern linkage
    printf("Foo got %d", my_num);
}

```

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/* This is prog_main.c */
#include <stdio.h>

void foo(int my_num); // Tells linker a is defined elsewhere

int main(void){
    int a_value = 10;
    extern int a;
    printf("Main value is: %d\n", a_value);
    printf("Calling foo with %d \n", ++a_value);
    foo(a_value); // Will raise error
    printf("Value of a is: %d\n", a);
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  - Can be ***automatic***, *static* or *dynamic* (advanced)
- ***Automatic***: The storage is allocated when the block in which the object was declared is entered and deallocated when it is exited by any means (**goto**, **return**, reaching the end).



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Yes it is unfortunate. A good reference is [available here.](#)

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Compare

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## Compare

```
#include <stdio.h>

void printx(){
    static int x = 0;
    x++;
    printf("value of x is %d \n",x);
}

int main(){
    printx();
    printx();
    printx();
    printx();

    return 0;
}
```

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void printx(){
    int x = 0;
    x++;
    printf("value of x is %d \n",x);
}

int main(){
    printx();
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# Next time

- Operators in C
- Basic I/O functions
- Control structures in C
- Debugging with GDB